*भारतीय मानक*
*Indian Standard*

**IS 17235 : 2019**

# चुम्बकीय रस्सी परीक्षण ( एम आर टी ) — विशिष्टि

# Magnetic Rope Testing ( MRT ) — Specification

ICS 77.140.65

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Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee, MED 06

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee, had been approved by the Mechanical Engineering Divisional Council.

An aerial ropeway is a special form of transportation system where passengers/materials are carried on a tensioned wire rope supported above the ground. In ropeways handling passengers, safety, reliability, and conformance to high-quality and good industry practices of steel wire ropes are paramount for securing the safety of the users. Aerial ropeways are particularly useful in regions where the facility in surmounting natural barriers gives them a great advantage over railways or roads, both of which may need the heavy civil engineering work to secure easy gradient. They are inexpensive to maintain, pollution free, environment friendly, does not affect aesthetics, their power demand is modest, and, they are not seriously affected by adverse climatic conditions.

Nothing in this standard is intended to contravene any provisions of the statutory regulations wherever they are in force.

Composition of the Panel-1 on 'Aerial Ropeways' of MED 06 responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# MAGNETIC ROPE TESTING ( MRT ) — SPECIFICATION

## 1 SCOPE

**1.1** Non-destructive testing (NDT) is one of the quality control and maintenance inspection methods on mechanical structures. Steel wire ropes are most significant part of ropeways. This standard covers the methodology for determination and evaluation of condition of ropes used in aerial ropeways. Periodic scanning of ropes using nondestructive method is suggested.

**1.2** Wire rope tester/defect graph with at least two channels LF and LMA shall be used for scanning of steel wire ropes.

## 2 REFERENCE

The Indian Standards listed at Annex A contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standards are encouraged to investigate the possibility of applying the most recent editions of the standards.

## 3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply:

**3.1 Local Fault (LF)** — Broken wire or corrosion pit creates radial magnetic flux leakage and LF sensor detects it as the rope passes through the sensor. This signal provides information about presence of local fault and to an extent information about its magnitude.

**3.2 Loss of Metallic Cross-sectional Area (LMA)** — Signal for LMA sensor is proportional to the volume of steel or the change in cross-sectional area. It provides information about loss of steel due to missing wire, continuous corrosion or abrasion.

## 4 METHODS OF OPERATION

### 4.1 Introduction

Ropes are usually subjected to proper inspection during its lifetime. Safe use of rope requires different methods of inspection, destructive and nondestructive testing with visual and instrumental inspection. Destructive inspection brings information about tested part only and does not represent full length of the rope. Visual examination alone is not suitable for detecting rope deteriorationlevel. Magnetic nondestructive evaluation is the suitable method for assessment of rope condition therefore MRT equipment employing this principle shall be used for scanning of ropes at site utilizing any of the following methods:

a) *Permanent Magnet Method* — Instruments for magnetic non-destructive evaluation of steel wire ropes generally uses 'DC magnetic method' (also known as permanent magnetic method) for magnetization of the rope with permanent magnets and detection of the changes of magnetic field around the rope and total magnetic flux. Inductive coils and/or Hall generators are very popular as sensing devices.

b) *Magnetic Flux Leakage Method* — Some instruments utilize magnetic flux leakage (MFL) principle of operation with strong magnetization of rope. Any changes in rope cross-sectional area as well as discontinuities, like broken wires or strands, pits of corrosion etc. causes changes in leakage flux of magnetic field. Magneto-sensitive sensors placed in the magnetic head, detect the changes of magnetic leakage flux.

## 5 SAFETY ASPECTS

### 5.1 Equipment

**5.1.1** *General*

**5.1.1.1** The equipment comprises a magnetic head, output monitoring/display unit with storage facility for recording data and /or chart recorder.

**5.1.1.2** The equipment shall be operated and maintained as per operating instruction manual.

**5.1.1.3** Readings using this instrument may not be possible at location where the machine is not able to access the entire surface of the rope like at termination points, saddles, anchor points, chain supports etc. due to the limitation of the machine.

**5.1.1.4** The test equipment shall be calibrated every two years.

### 5.2 Magnetic Head

Magnetic head with manufacturers recommended guards shall be used for a particular range of rope diameter. All sensors for LF, LMA and distance counter etc. shall be housed in the magnetic head. It encompasses the area around the rope for its magnetization during rope movement.

### 5.3 Display or Basic Unit/Chart Recorder

Visual display unit/data logger unit/basic unit shall display the length of the rope assessed, value of LF and LMA etc. during the test. This will store the entire data during inspection and then will be transferred to Computer or any other storage device for analysis and comparison in future.

### 5.4 Personnel

Testing personnel shall have basic knowledge of rope installed and to be inspected. They shall also have experience of operating the electromagnetic instruments for nondestructive evaluation of ropes. Such testing personal should have certification from OEM of the MRT machine for operation and evaluation of test result. NDT level 2 certified personnel are also authorised to perform the MRT operations.

### 5.5 Instrument Operation

**5.5.1** *Setting of the Instrument for Test*

**5.5.1.1** Before starting the procedure, the rope under test shall be magnetized by moving the magnetic head over rope for 1-2 metres. The instrument/rope tester shall be calibrated in air and with the rope inside each time before scanning the rope.

**5.5.1.2** Necessary arrangements shall be made for fixing the equipment and smooth scanning of the rope so that either the rope under test may pass freely through the head or the rope-tester may run smoothly along the rope inside head with the infrastructure arrangement.

**5.5.1.3** The rope tester shall be tested with sample rope/wire with few manual cut in its strand(s) before scanning the rope in the ropeway.

### 5.6 Results

**5.6.1** The personnel responsible for carrying the test shall store the data and interpret the results in the report.

**5.6.2** The major findings shall be highlighted.

**5.6.3** Old and present readings shall be correlated, if possible.

**5.6.4** The report shall have recommendation and suggestion based on the current rope condition for continuance/ discard considering the aspects of all relevant Indian Standards for wire ropes.

## 6 TEST REPORT

The test report shall include the followings:

a) Detail of rope and installation;
b) Date of test;
c) Date of previous test if any;
d) Equipment detail and setting;
e) Direction of rope movement and length scanned;
f) Average speed of rope under test;
g) Lay length of the rope and the changes with reference to the previous value;
h) Average diameter of the rope noticed and comparison with the nominal value;
j) Spliced lengths in case of haulage ropes;
k) Any other visual findings; and
m) Recommendation(s) containing:
    1) Accept/discard of rope in the installation. Reference from IS 3973 and other relevant IS on wire ropes may be taken; and
    2) Next date of nondestructive inspection of aerial ropes.

# ANNEX A

( *Clause* 2 )

## APPLICABLE INDIAN STANDARDS ON WIRE ROPES

| *IS No.* | *Title* |
|---|---|
| 3973 : 1984 | Code of practice for the selection, installation and maintenance of wire ropes (*first revision*) |
| 5228 : 2017 | Code of practice for construction of continuous movement monocable ropeways with fixed grips intended for transportation of passengers |
| 5229 : 2017 | Code of practice for construction of continuous movement monocable ropeways with automatic grips intended for transportation of passengers |
| 5230 : 2017 | Code of practice for construction of continuous to and fro movement bicable ropeways intended for transportation of passengers |
| 9706 : 1997 | Aerial ropeways for transport of material — code of practice for design and construction (*first revision*) |
| 16620 : 2017 | Jig back movement monocable ropeways with fixed grips — Code of practice |
| 16623 : 2017 | Pulsated movement monocable ropeway with fixed grips — Code of practice |

# ANNEX B

( *Foreword* )

## COMMITTEE COMPOSITION

Composition of the Panel-1 on 'Aerial Ropeways' MED 06

| *Organizations* | *Representative(s)* |
|---|---|
| In Personal Capacity | SHRI A. BHADRA (***Convener***) |
| In Personal Capacity | SHRI C. K. KARMAKAR |
| In Personal Capacity, Kolkata | SHRI DWIJENDRA LAL DAS (*Invitee*) |
| CSIR-CIMFR, Dhanbad | DR DEBASISH BASAK |
| CRS, Pvt Ltd, Kolkata | SHRI K. BOSE |
| Damodar Ropeways & Infra Ltd, Kolkata | SHRI RANJAN MUKHERJEE |
| Usha Breco Limited, Ghaziabad | SHRI MANOJ PANWAR |

*Member Secretary*

SHRI A. K. MOHINDROO
SCIENTIST 'C' (MED), BIS

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This Indian Standard has been developed from Doc No.: MED 06 (13779).

## Amendments Issued Since Publication

| Amend No. | Date of Issue | Text Affected |
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